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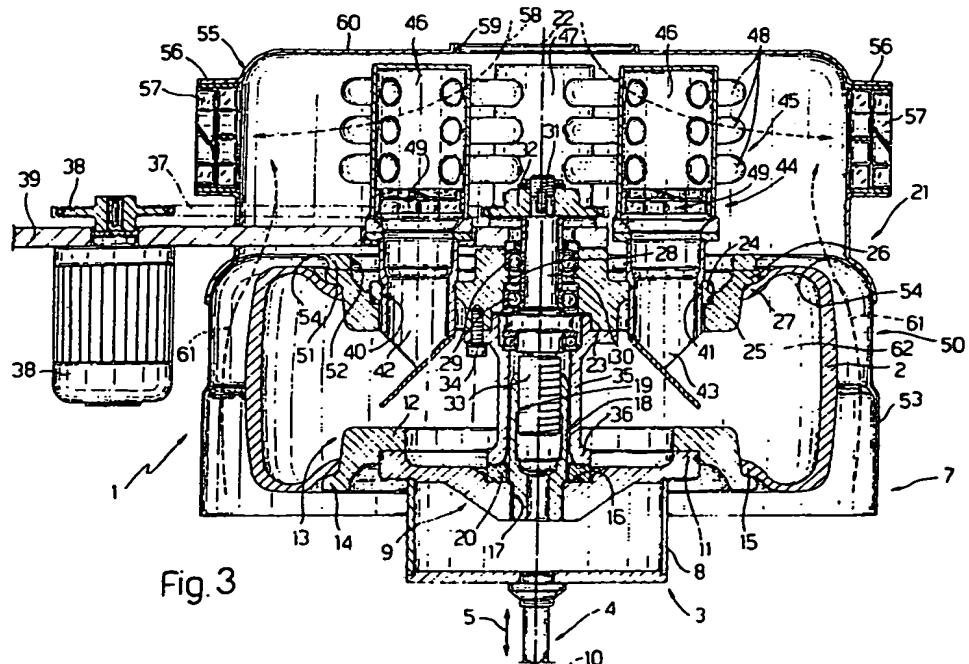
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### ④ Method and device for stabilizing cured tires.

⑤ A method and device (1) for stabilizing tires extracted at relatively high temperature from a curing mold, whereby the tire (2) to be stabilized is inflated to a given pressure by a pressurized fluid,

and cooled from the inside by circulating the pressurized fluid along a closed circuit (44) defined, at least partially, by the tire (2) and by a radiator (45) located outside the same.



The present invention relates to a method of stabilizing cured tires.

In particular, the present invention relates to a method of stabilizing tires extracted, at a relatively high temperature, generally of about 180 °C, from a curing mold.

When manufacturing tires, particularly vehicle tires comprising internal body plies formed from nylon cords or other synthetic fibres which shrink when cooled, it is now customary to subject each tire, upon extraction from the curing mold, to a stabilizing operation generally consisting in mounting the tire on a support, inflating it to a given pressure, usually of about 3 atmospheres, and maintaining this pressure long enough for the tire to cool below a given temperature, usually of about 100 °C.

Such a process, usually referred to as "post inflation", provides, not only for preventing the synthetic cords from shrinking, thus resulting in undesired distortion of the tire, but also for stabilizing the shape of the cords, which is extremely useful in terms of finished tire quality.

Stabilizing cured tires, however, usually involves a number of drawbacks for the manufacturer, mainly due to the relatively long time required for cooling, and the size of currently used stabilizing equipment. Generally speaking, in fact, the time required at present for ensuring correct stabilization of the tire is roughly twice that required for curing. Consequently, two stabilizing machines are usually required for each curing mold, each of which machines usually features complex centralized systems for supplying cooling fluids such as water and/or air, for cooling the outer surface of the tires during stabilization.

The aim of the present invention is to provide a tire stabilizing method designed to overcome the above drawbacks, and which enables relatively fast cooling of tires extracted from a curing mold, with no need for centralized systems.

With this aim in view, according to the present invention, there is provided a method of stabilizing cured tires extracted at relatively high temperature from a curing mold; said method comprising a stage consisting in inflating said tire to a given pressure by means of a pressurized fluid, and being characterised by the fact that it also comprises a stage consisting in cooling said tire from the inside by circulating said pressurized fluid along a closed circuit defined at least partially by said tire and by radiating means outside the same.

The above method preferably comprises a further stage consisting in generating, via fan means, a forced stream of outside air through said radiator means and, if necessary, over the outer surface of said tire.

According to a preferred embodiment of the

above method, prior to being inflated by said pressurized fluid, the tire is engaged with supporting means cooperating with the tire and defining with the same a fluidtight chamber; said chamber forming part of said closed circuit for circulating said pressurized fluid, and said pressurized fluid being force circulated along said circuit.

The present invention also relates to a device for stabilizing cured tires extracted at relatively high temperature from a curing mold; said device comprising means for supplying pressurized fluid inside said tire and inflating the same to a given pressure, and being characterised by the fact that said supply means comprise a closed circuit for circulating said pressurized fluid; said circuit being defined at least partially by said tire and comprising radiator means outside the same.

The above device preferably also comprises fan means for generating a forced stream of outside air through said radiator means, and, if necessary, conveying means for conveying part of said forced stream of outside air over the outer surface of said tire.

According to a preferred embodiment, the above device comprises supporting means designed to cooperate with said tire and define, with the same, a fluidtight chamber; said chamber forming part of said closed circuit for circulating said pressurized fluid; and force circulating means being housed inside said circuit.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 shows a schematic, partially-sectioned plan view, with parts removed for simplicity, of a preferred embodiment of a cured tire stabilizing device in accordance with the present invention; Fig.s 2 and 3 show sections along line II-II in Fig.1 of the Fig.1 device in two distinct operating positions.

Number 1 in the accompanying drawings indicates a device for stabilizing tires 2 extracted from a curing mold (not shown) at a relatively high temperature, generally of about 180 °C.

As shown more clearly in Fig.s 2 and 3, device 1 comprises a lower supporting unit 3 connected to the top end of an actuator 4 for moving unit 3 vertically, as shown by arrow 5, between a lowered idle position (Fig.2) and a raised operating position (Fig.3). Actuator 4 may be fixed or, as in the example shown, connected to an arm 6 designed to move, by virtue of activating means (not shown), between a loading station (not shown) at said curing mold (not shown), and a stabilizing station 7.

With reference to Fig.3, unit 3 also comprises a tubular body 8 constituting the output element of actuator 4 and fitted, on the top end, integral with a substantially round plate 9 having a substantially

vertical axis 10. The outer edge of plate 9 presents an upper annular rib 11 for supporting and connecting, by means of screws (not shown), a flange 12 extending inwards from the narrower end of an annular, substantially truncated-cone body 13 coaxial with axis 10 and tapering upwards. The lateral surface of annular body 13 presents an outer flange 14 defining a supporting surface for a respective bead portion 15 of tire 2.

Plate 9 presents an upper central cavity 16 coaxial with axis 10 and having a central threaded through hole 17 engaged by a threaded portion of a tubular appendix 18 extending upwards from plate 9 and having a threaded axial hole 19 coaxial with axis 10.

Cavity 16 houses a tubular spacer 20 fitted on to appendix 18 and selectable from a series of spacers (not shown) of the same type but differing in thickness.

Device 1 also comprises a second supporting unit indicated as a whole by 21 and mounted in fixed manner at stabilizing station 7, in such a position that, when unit 3 is in stabilizing station 7, unit 21 is located over unit 3 with axis 22 coaxial with axis 10.

Unit 21 comprises a central hub 23 coaxial with axis 22 and having an outer flange 24. The outer edge of flange 24 is connected, in removable manner (not shown), to an inner peripheral portion of an annular, substantially truncated-cone body 25 coaxial with axis 22 and directly facing annular body 13 when unit 3 is in stabilizing station 7. As in the case of annular body 13, the lateral surface of annular body 25 presents a flange 26 defining a supporting surface for a respective bead portion 27 of tire 2.

Through hub 23, there is formed an axial hole 28 housing, via the interposition of a number of bearings 29, a rotary shaft 30, one portion 31 of which projects from the top of hub 23 and is fitted with a toothed pulley 32, and another externally threaded portion 33 of which projects from the bottom of hub 23 and is designed to engage threaded hole 19 in appendix 18 when unit 3 is in stabilizing station 7.

The surface of hub 23 facing unit 3 is fitted, by means of screws 34, with the outer flange of a tubular appendix 35 coaxial with axis 22, longer than appendix 18, and having an inside diameter at least equal to the outside diameter of the same. The bottom end of tubular appendix 35 presents a flange 36 by which appendix 35 rests in fluidtight manner on the upper surface of spacer 20 when portion 33 of shaft 30 engages appendix 18 subsequent to upward displacement of unit 3 by actuator 4, and rotation of pulley 32 by a toothed belt 37 powered by a reversible motor 38 supported on a plate 39 integral with hub 23 and extending lat-

erally from the top end of hub 23.

Flange 24 presents a first and second pair of diametrically-opposed axial holes, 40 and 41, located in perpendicular planes through axis 22. Holes 40 and 41 are respectively engaged in fluid-tight manner by the inlet and outlet conduits 42 and 43 of a circuit 44 for circulating pressurized fluid, preferably nitrogen, supplied to circuit 44 through a known inlet and drain valve (not shown). One portion of circuit 44 consists of a radiator 45 constituting the upper portion of element 21 and comprising a pair of vertical pipes 46 connected to the top end of conduits 42, and a further pair of vertical pipes 47 connected to the top end of conduits 43. Radiator 45 also comprises a number of transverse loop conduits 48 connecting pipes 45 and 46.

For force circulating said pressurized fluid along circuit 44, each of vertical pipes 46 and 47 houses an appropriately oriented power fan 49.

Unit 21 comprises a conveyor bell 50 with a base wall 51 perpendicular to axis 22 and having a central hole 52 substantially equal in diameter to the inside diameter of the wider upper end of annular body 25. Wall 51 is secured, via means not shown, to the upper end surface of annular body 25, and is fitted on its outer edge with a substantially cylindrical lateral wall 53 facing downwards.

Through wall 51 and coaxially with central hole 52, there is formed a ring of openings 54 enabling communication between bell 50 and a substantially cylindrical conveyor 55 surrounding radiator 45 and having its bottom end connected to wall 51 outwards of openings 54. Through conveyor 55, there are mounted a number of radial conduits 56 communicating externally and each housing a powered extractor 57 for drawing in air both from above (arrows 58 in Fig.3) through a central hole 59 formed through upper wall 60, and from below (arrows 61 in Fig.3) through openings 54.

In actual use, a tire 2 extracted from a curing mold (not shown) is placed between units 3 and 21 in stabilizing station 7. In the specific embodiment shown, tire 2 is placed on annular body 13 of unit 3, with lower bead portion 15 substantially resting on flange 14. Via displacement of arm 6, unit 3, which is maintained by actuator 4 in the lowered idle position, is then moved into stabilizing station 7, coaxial with axis 22 and at such a height as to enable tire 2 to pass beneath flange 35 of appendix 34 on unit 21.

Actuator 4 is then operated so as to raise unit 3 into the operating position and gradually bring tubular appendix 18 into engagement with appendix 35 and subsequently into contact with the bottom end of lower portion 33 of shaft 30. Operation of motor 38 gradually engages portion 33 of shaft 30 and appendix 18, so as to bring flange 36 of

appendix 35 into fluidtight contact with the upper surface of spacer 20, which is so selected that, subsequent to fluidtight contact of flange 36 and spacer 20, bead portion 27 of tire 2 substantially contacts flange 26 which is located a given distance from flange 14 contacting bead portion 15. This defines, between units 3 and 21, an annular chamber 62 extending inwards of tire 2 and connecting inlet and outlet conduits 42 and 43 of circuit 44, which may now be fed with said pressurized fluid for inflating tire 2, engaging bead portions 15 and 27 of tire 2 in fluidtight manner with respective flanges 14 and 26, and outwardly sealing in fluidtight manner chamber 62.

At this point, fans 49 may be operated for force circulating said fluid along circuit 44 and through radiator 45, which is swept from above by a stream of cooling air drawn in by extractors 57 in the direction of arrows 58 in Fig.3. Said air stream provides for rapidly cooling the pressurized fluid circulating at high speed inside circuit 44, and therefore for rapidly cooling tire 2 as a whole until the required stabilizing temperature is reached. Known compensating members (not shown) obviously provide for maintaining the fluid inside circuit 44 at a given constant pressure during cooling.

In other words, therefore, the same fluid is employed for both inflating tire 2 and cooling it from the inside.

According to the embodiment shown, the internal action of said pressurized fluid is preferably, though not necessarily, accompanied by the external action of a further stream of cooling air, which sweeps over the outer surface of tire 2 and is drawn in from below into bell 50 by extractors 57 through openings 54 (which may be dispensed with) in the direction of arrows 61 in Fig.3.

An important point to note in connection with stabilizing device 1 as described above is that, in addition to cooling tire 2 internally by force circulating said pressurized fluid, thus drastically reducing the cooling time currently required on known stabilizing devices, device 1 is extremely compact and lightweight, and may be installed off the floor, thus eliminating the frequently high cost of providing for a machine bed.

Moreover, the structure of device 1 as described above provides for a high degree of flexibility, and for making relatively rapid changes, within a given range, to the format of tires having the same inside diameter, said change in format being achieved by simply changing spacer 20, which provides for fluidtight engagement of units 3 and 21 and a given clearance between annular bodies 13 and 25.

1. A method of stabilizing cured tires extracted at relatively high temperature from a curing mold; said method comprising a stage consisting in inflating said tire (2) to a given pressure by means of a pressurized fluid, and being characterised by the fact that it also comprises a stage consisting in cooling said tire (2) from the inside by circulating said pressurized fluid along a closed circuit (44) defined at least partially by said tire (2) and by radiating means (45) outside the same.
2. A method as claimed in Claim 1, characterised by the fact that it comprises a further stage consisting in generating, via fan means (57), a forced stream of outside air through said radiator means (45).
3. A method as claimed in Claim 2, characterised by the fact that it comprises a further stage consisting in generating, via said fan means (57), a forced stream of outside air over the outer surface of said tire (2).
4. A method as claimed in any one of the foregoing Claims, characterised by the fact that, prior to being inflated by said pressurized fluid, said tire (2) is engaged with supporting means (3, 21) cooperating with said tire (2) and defining, with the same, a fluidtight chamber (62); said chamber (62) forming part of said closed circuit (44) for circulating said pressurized fluid; and said pressurized fluid being force circulated along said circuit (44).
5. A method as claimed in Claim 4, characterised by the fact that said supporting means comprise two opposed supporting units (3, 21), one of which (21) supports said radiator means (45); said tire (2) being placed between said two supporting units (3, 21), which are then connected so as to cooperate in fluidtight manner with respective bead portions (15, 27) of said tire (2), and define, together with said tire (2), said chamber (62).
6. A device for stabilizing cured tires extracted at relatively high temperature from a curing mold; said device comprising means for supplying pressurized fluid inside said tire and inflating the same to a given pressure, and being characterised by the fact that said supply means comprise a closed circuit (44) for circulating said pressurized fluid; said circuit (44) being defined at least partially by said tire (2) and comprising radiator means (45) outside the same.

## Claims

7. A device as claimed in Claim 6, characterised by the fact that it also comprises fan means (57) for generating a forced stream of outside air through said radiator means (45).

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8. A device as claimed in Claim 7, characterised by the fact that it also comprises conveying means (50) for conveying part of said forced stream of outside air over the outer surface of said tire (2).

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9. A device as claimed in any one of the foregoing Claims from 6 to 8, characterised by the fact that it comprises supporting means (3, 21) designed to cooperate with said tire (2) and define, with the same, a fluidtight chamber (62); said chamber (62) forming part of said closed circuit (44) for circulating said pressurized fluid; and means (49) for force circulating said pressurized fluid being housed inside said circuit (44).

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10. A device as claimed in Claim 9, characterised by the fact that said supporting means comprise two opposed, facing supporting units (3, 21), each designed to cooperate in fluidtight manner with a respective bead portion (15, 27) of said tire (2); and means (18, 33) for releasably connecting said two units (3, 21) and engaging the same with respective said bead portions (15, 27) for defining said chamber (62).

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11. A device as claimed in Claim 10, characterised by the fact that said connecting means (18, 33) comprise a screw-nut screw coupling.

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12. A device as claimed in Claim 11, characterised by the fact that said screw-nut screw coupling (18, 33) is powered.

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13. A device as claimed in Claim 11 or 12, characterised by the fact that spacer means (20, 35) of adjustable length are provided between said two supporting units (3, 21).

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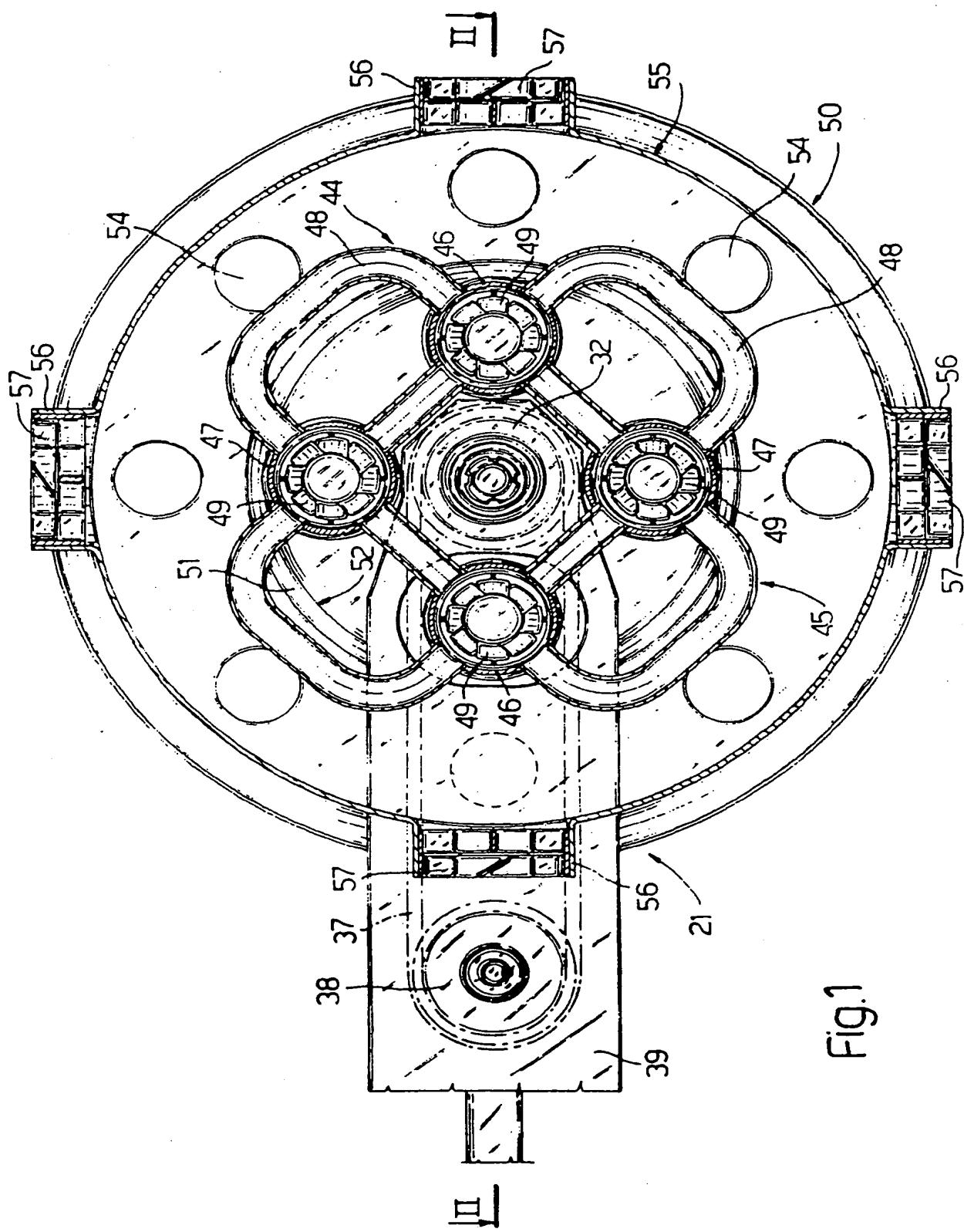
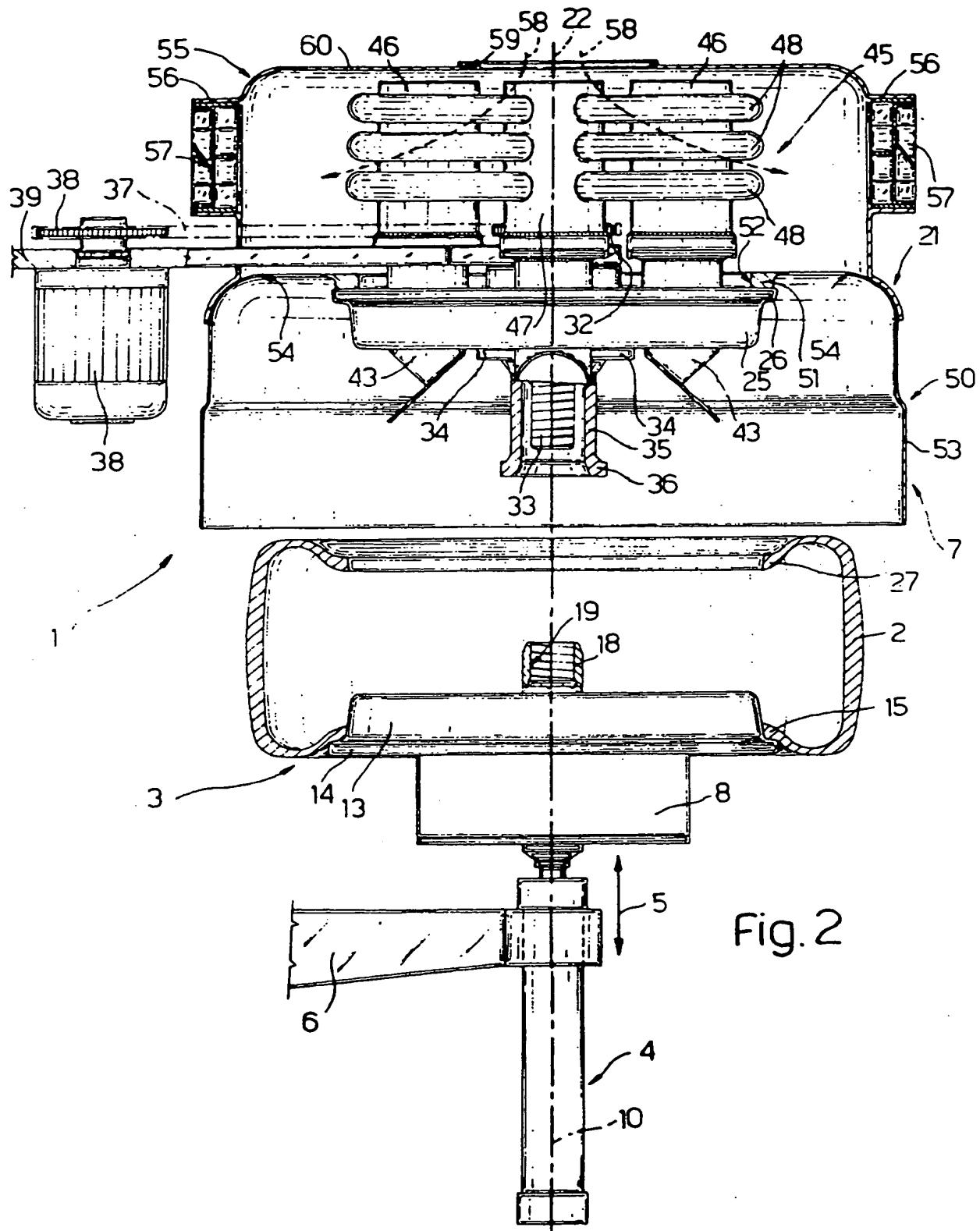


Fig. 1



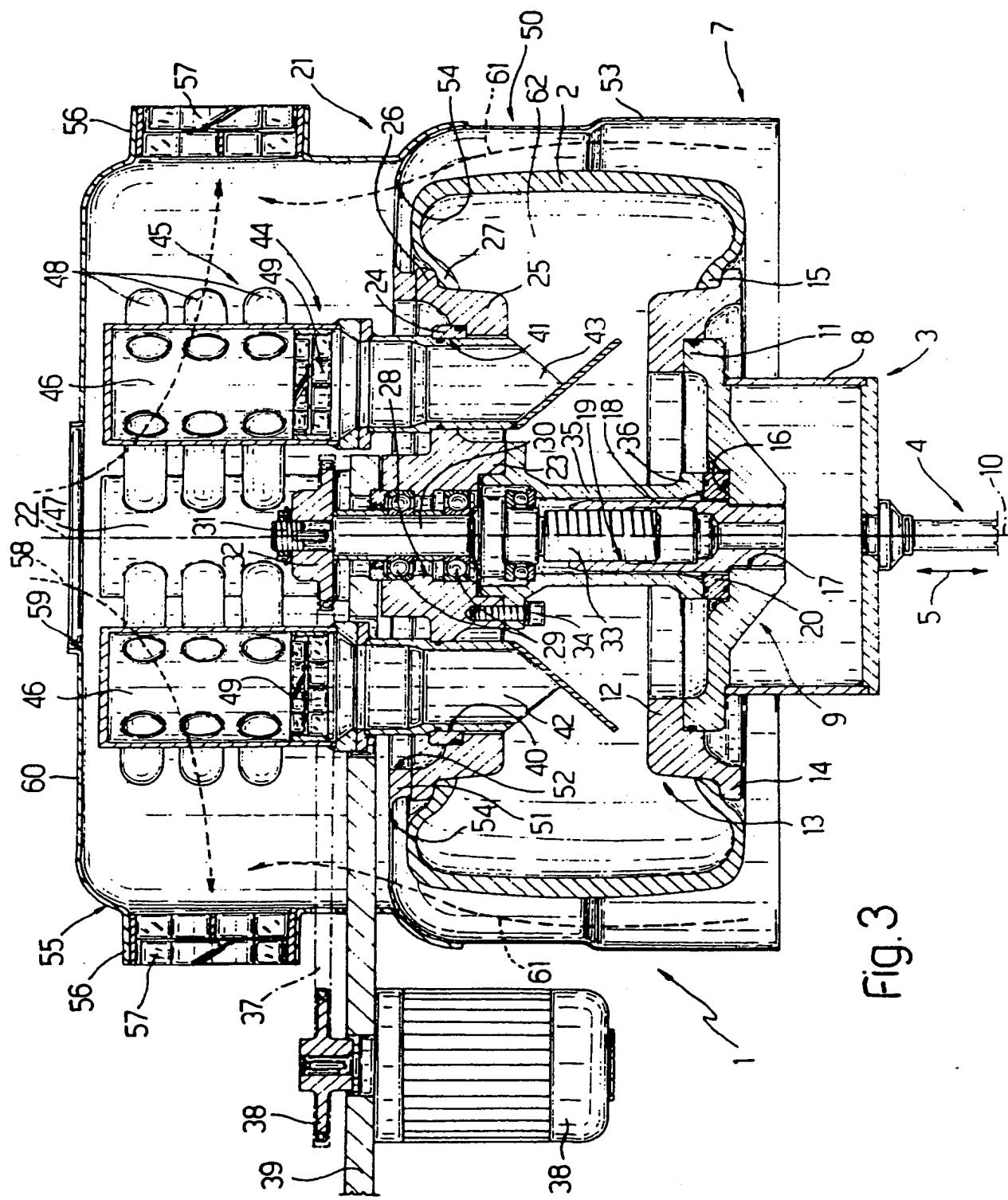


Fig. 3



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REPORT

Application Number

EP 91 11 1888

DOCUMENTS CONSIDERED TO BE RELEVANT		Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL5)		
Category	Citation of document with indication, where appropriate, of relevant passages				
A	US-A-3 667 881 (F. CIMPRICH) -----	1,6	B 29 D 30/06		
A	US-A-3 852 008 (D. SHICHMAN) -----	1,6			
A	US-A-3 692 444 (R. HUGGER) -----	1,6			
A	US-A-3 495 296 (D. ERICSON) -----	1,6			
TECHNICAL FIELDS SEARCHED (Int. Cl.5)					
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The present search report has been drawn up for all claims					
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The Hague	04 September 91	DECLERCK J.T.			
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